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STUDIES ON THE QUALITY OF FISH HELD IN CHILLED SEAWATER AND IN ICE

PART VIb

By

Tertnes,G., Losnegard,N. and Langmyhr,E.

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EXAMINATION OF THE QUALITY OF FISH STORED IN CHILLED SEAWATER AND IN ICE ; VI b

by

Tertnes, G., Lösnegard, N. and Langmyhr, E.

SUMMARY

Small pollock (Pollachius virens), gutted and headed, and the same fish, gutted, not headed but gills removed, were stored in chilled seawater (RSW) and in ice for up to 13 days.

Samples were taken several times during the storage period and examined by sensory, chemical, and bacteriological methods. Samples were taken for analyses immediately after the end of the trial and after one year's refrigeration.

The first part of the study is described in Report No. 9/83, Reports and Notes of the Directorate of Fisheries (1). The present report describes the samples after one year's refrigeration.

Sensory assessment of cooked samples showed that fish stored in ice was judged superior to tank-stored fish, when the storage period was 6 days or more. No significant differences were found in the quality of samples stored in ice. Differences between ice-stored and tank-stored fish were more obvious than they were in refrigerated samples.

Volatile nitrogen compounds were at a level corresponding to those previously found for refrigeration. Dimethylamine, normally used as an indicator of refrigeration stress , showed no real increases for any of the variants.

There was a notable decrease in drippage after a tank-storage period of 6 - 9 days. It was assumed that this was connected with the salt content of the tank-stored fish.

INTRODUCTION

This report describes Part 2 of an experimental project earlier published in Report NO. 9/83 in the series Reports and Notes, Directorate of Fisheries. (1). The project was the sixth in a series aimed at illuminating the various factors of importance for the quality of fish during holding in ice and in refrigerated seawater (RSW).

In this report the fish are being evaluated by chemical, bacteriological and sensory criteria after having been held in cold storage for one year.

MATERIAL

The sample fish were divided into 2 groups according to the methods of treatment:

C. Gutted, headed

D. Gutted, with head, without gills

Fish C and D were held in ice and in tank up to 13 days. Fish C were handled according to quality regulations in effect and function as reference (controls) throughout the whole project.

Samples were taken out after 1, 3, 6, 9 and 13 days. After each sampling the fish were headed, filleted and skinned and then frozen immediately. Before freezing the fillets were wrapped in plastic film and packaged in waxed cartons. One series was analyzed immediately after the end of the experiment while one series was stored for one year at -25 C before being analyzed.

METHODS

The analytical methodology was the same as described in the report of experimental projects I and VI (1, 7).

RESULTS AND DISCUSSION

Sensory analyses after i years frozen storage.

The sensory evaluation of cooked samples was done by a taste panel with 6 judges. Five taste panel samplings were carried out,

one for each storage period. In addition to the stored samples, fish that had been frozen completely fresh were served as controls at each sampling.

Table 1. Quality points for cooked samples.

Storage time (days)	Samples			
	Ci	Di	Ct	Dt
0		7,1		
1	6,9	6,3	7,0	6,0
3	6,8	6,6	5,8	6,2
6	7,2	7,2	5,7	6,2
9	5,8	6,0	5,2	5,0
13	4,8	4,9	3,3	3,3

Ci = Gutted, headed, held in ice
Ct = Gutted, headed, held in tank
Di = Gutted, w/head, without gills, held in ice
Dt = Gutted, w/head, without gills, held in tank

The tables give the total impression as the averages of the points awarded by the 6 judges.

For fish held 6 days or less in ice there is no connection between holding time and quality rating points. Fish held one day in ice is clearly judged too low. The same is the case for gutted fish with head on held in tank (Dt). It is especially odour and flavor that pulls down the total impression for these samples, while for fish held 3 and 6 days it is in most cases the texture that pulls down the overall impression. p.4

For fish held for 6 days or more, those held in tank have a definitely lower quality than fish held in ice, and after 9 days in tank the fish are on the borderline of being acceptable. Fish held for 13 days, both in ice and in seawater, are of unacceptable quality.

In addition to the quality evaluation, the fish were rated according to total quality.

Table 2. Rating of the samples.

Holding time(days)	Rating no.			
	1	2	3	4
1	Ct	Ci	Dt	Di
3	Ci	Di	Dt	Ct
6	Di	Ci	Dt	Ct
9	Di	Ci	Ct	Dt
13	Di	Ci	Ct	Dt

The sample designations are as in Table 1. The samples are arranged according to increasing ranking, i.e. falling qualities. Samples that are not significantly different ($p<0.05$) are underlined with the same line.

For samples held for 1 and 3 days there are no significant differences between the samples. For samples held 6 days and more the fish held in ice are significantly better than fish held in tank. The difference between fish held in ice and fish held in tank is clearer than before cold storage. (1).

The judges were instructed to not consider any salty taste in evaluating the quality. Salty taste was evaluated separately and is given in Table 3.

Table 3. Salty flavor in the fish

Holding time (days)	Samples			
	Ci	Di	Ct	Dt
0		0,0		
1	0,0	0,2	0,2	0,2
3	0,0	0,0	1,6	2,2
6	0,0	0,0	2,2	2,0
9	0,0	0,6	2,5	2,3
13	0,2	0,0	3,0	2,8

Saltiness was evaluated according to the following scale:

0 - No salty flavor
1 - Indication of salty flavor
2 - Some salty flavor (no doubt)
3 - Obvious salty flavor

The sample designations are as in Table 1. The values in the table represent the averages of the scores given by the 6 judges.

Fish held in ice have largely received lower, and tank held fish higher values for salty flavor than before cold storage. An exception is gutted fish with hesd held for 6 days in tank which is judged lower than normal. p.5

Chemical and bacteriological analyses of the fish after 1 year in frozen storage.

Table 4. TMAO_N and volatile nitrogen compounds.

Days in Tank	Ice	TMAO-N mg/100g. C	TMAO-N mg/100g. D	Tot.Vol.N mg/100g C	Tot.Vol.N mg/100g D	TMA-N mg/100g C	TMA-N mg/100g D	DMA-N mg/100g C	DMA-N mg/100g D	TMA-N mg/100g C	TMA-N mg/100g D
0	0	35,6		14,5		0		1,1		0,2	
1	0	32,9	35,3	14,3	14,3	0,1	0	1,1	2,1	0,2	0,3
3	0	29,8	31,9	15,8	14,9	1,2	0	2,9	2,2	0,5	0,3
6	0	29,6	30,0	15,6	14,4	0,8	1,0	3,3	1,7	0,8	0,6
9	0	23,7	26,0	12,8	13,0	2,7	1,2	2,2	2,1	2,5	2,5
13	0	15,3	15,7	20,6	19,6	8,0	5,8	2,0	2,4	9,5	11,1
0	1	31,0	34,0	15,4	15,2	0,1	0,7	1,5	1,6	0,2	0,3
0	3	31,5	31,5	13,4	13,8	0	0,3	1,4	1,8	0,2	0,2
0	6	28,0	27,0	9,6	14,0	0,4	1,6	1,7	2,1	0,3	0,3
0	9	27,5	28,8	10,4	11,9	0,8	0,7	2,2	2,6	0,3	0,4
0	13	25,0	22,6	13,3	16,6	1,4	4,7	2,9	3,4	0,7	0,9

1) Determined according to Bullard and Collins (2).

Table 4 shows the values for the volatile nitrogen compounds and TMAO-N in the fish after frozen storage for 1 year.

None of these parameters have changed substantially during frozen storage.

The content of DMA-N, which is usually used as an indicator of frozen storage abuse, is low. This indicates that storage conditions were satisfactory.

Table 5. Hypoxanthine and drip - and press water

Days in Tank	Ice	Hypoxanthine mg/100g C	Hypoxanthine mg/100g D	Drip and presswater. g/100g C D	C P	C D+P	D D	D P	D D+P
0	0	5		20	28	48	20	28	48
1	0	11	12	10	28	38	12	30	42
3	0	14	13	11	29	40	12	26	38
6	0	18	15	3	22	25	9	19	28
9	0	22	21	3	19	22	2	18	20
13	0	28	33	1	17	18	1	19	20
0	1	12	14	9	27	36	13	29	42
0	3	13	16	15	32	47	10	33	43
0	6	14	14	15	32	47	10	33	43
0	9	21	19	13	27	40	9	35	44
0	13	26	23	15	33	48	15	31	48

D= drip water
P= press water

The hypoxanthine content increase with the storage time in tank and in ice and is on the same level as before frozen storage. p.6

Drip water shows a marked decrease after 6 -13 days holding in tank. No corresponding results were found for fish held in ice. This is probably connected with the salt content in the fish which after 6 days holding in tank was 0.7% (1). Earlier experiments in this series have also shown that there is a marked decrease in the amount of drip water for the longest holding times in tank after 1 years cold storage. (3, 4, 5, 6)

Table 6. Bacteriological analyses of fillets.

Days in Tank	Ice	Total number of live bacteria per g.at 20 C C	D
0	0	3 500	3 500
1	0	4 350	1 850
3	0	11 000	2 200
6	0	2 300	2 500
9	0	1 000	20 000
13	0	5 500	5 000
0	1	1 000	100
0	3	21 000	2 000
0	6	11 000	3 100
0	9	3 000	10 000
0	13	15 000	38 000

The bacteria content in the fish shows a marked decline after 1 years frozen storage. It is assumed that this is due to freezer kill during frozen storage.

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